What is claimed is:

1. A pneumatic spring apparatus having a gas chamber filled with a gaseous substance of a predetermined pressure, comprising a regulating device provided in the gas chamber for regulating a temperature change produced according to a volume change of the gas chamber.

2. The pneumatic spring apparatus of claim 1, wherein the regulating device is a solid or a liquid exhibiting a greater specific heat or heat transfer rate than the gaseous substance.

3. The pneumatic spring apparatus of claim 1 or 2, wherein the regulating device is fiber-shaped steel.

4. The pneumatic spring apparatus of any one of claims 1 to 3, wherein the regulating device is adapted to make a polytropic index for a dynamic spring constant smaller than a polytropic index of the air.

5. The pneumatic spring apparatus of any one of claims 1 to 4, wherein the regulating device includes a gas formed of a mixture of saturated vapor and liquid filled in the gas chamber in a gas liquid mixed phase condition.

6. The pneumatic spring apparatus of any one of claims 1 to 5, wherein the regulating device is adapted to allow a volume of the gas chamber to be changed nearly isothermally.

7. The pneumatic spring apparatus of any one of claims 1 to 6, further comprising a stirring device for stirring the gaseous substance in the gas chamber.

8. An anti-vibration apparatus comprising:

a support device for supporting a target anti-vibration object with a gaseous substance of a predetermined pressure; and

a drive device for driving the target anti-vibration object,

wherein the pneumatic spring apparatus of any one of claims 1 to 7 is employed as the support device.

9. A stage apparatus in which a movable body is moved on a surface plate, wherein the surface plate is supported by the anti-vibration apparatus of claim 8.

10. An exposure apparatus for use in exposing patterns of a mask held on a mask stage onto a photosensitive substrate held on a substrate stage through a projection optical system, wherein at least one of the mask stage, the projection optical system and the substrate stage is

supported by the anti-vibration apparatus of claim 8.

11. An anti-vibration method comprising the steps of:

filling a gaseous substance of a predetermined pressure into a gas chamber; and

regulating a temperature change produced according to a volume change of the gas chamber.

12. The anti-vibration method of claim 11, wherein a solid or a liquid exhibiting a greater specific heat or heat transfer rate than the gaseous substance is filled in the gas chamber.

13. The anti-vibration method of claim 11 or 12, wherein fiber-shaped steel is filled in the gas chamber.

14. The anti-vibration method of any one of claims 11 to 13, wherein a polytropic index for a dynamic spring constant is made smaller than a polytropic index of the air.

15. The anti-vibration method of any one of claims 11 to 14, wherein a gas formed of a mixture of saturated vapor and liquid is filled in the gas chamber in a gas liquid mixed phase condition.

16. The anti-vibration method of any one of claims 11 to

15, wherein a volume of the gas chamber is changed nearly isothermally.

17. The anti-vibration method of any one of claims 11 to 16, wherein the gaseous substance in the gas chamber is stirred.